



# Industry 4.0 @ Feng Chia University

**Prof Dr. Shu-Yii WU**

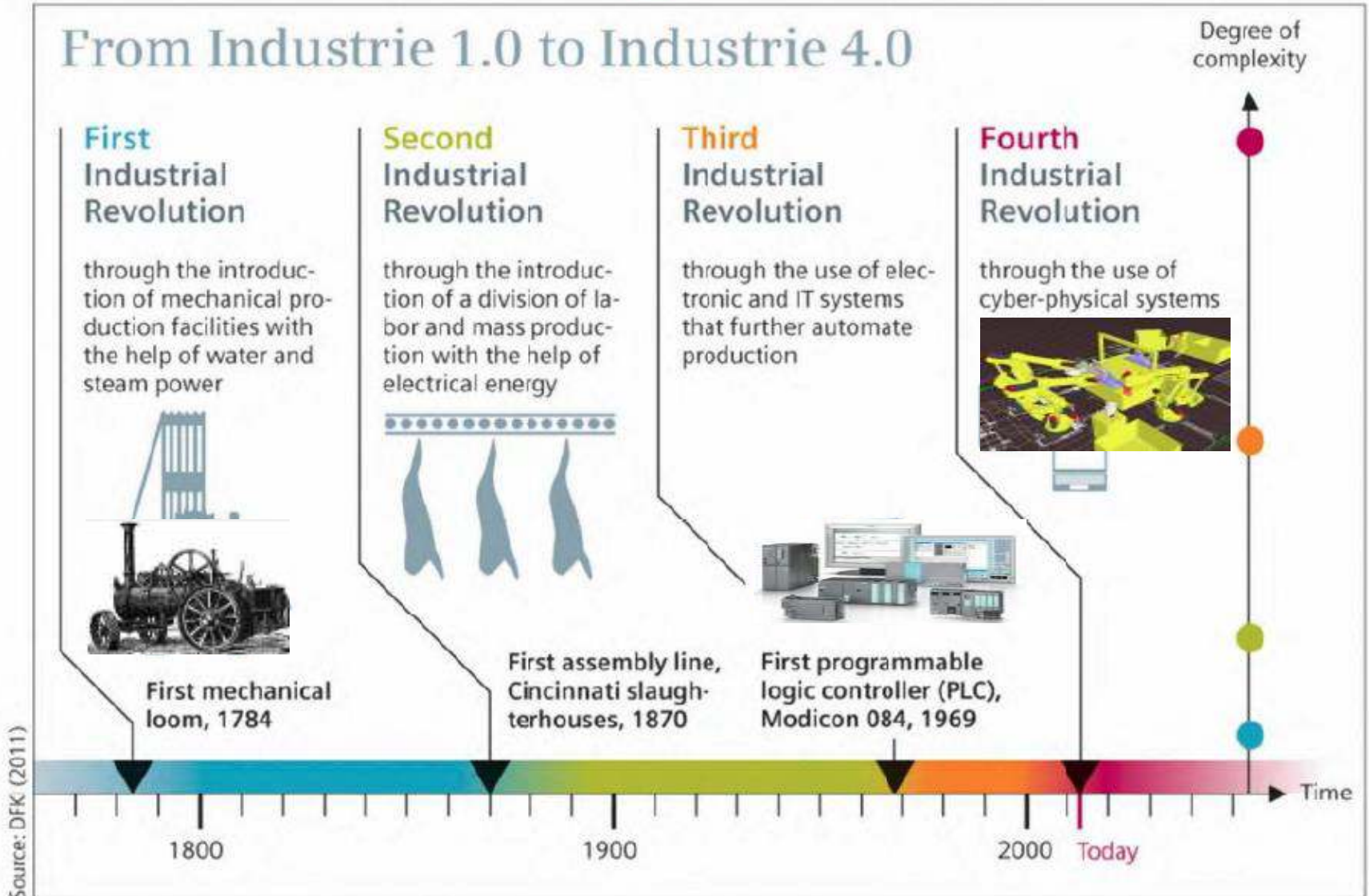
Chair, UKM-YSD, Malaysia  
Dean, COE, Feng Chia University, Taiwan  
2017/07/19, UTAMA, UKM

# OUTLINE

- Background of Industry 4.0
- Industry 4.0 & Current Smart Machine Industries
- Industry 4.0 Action Plan @FCU

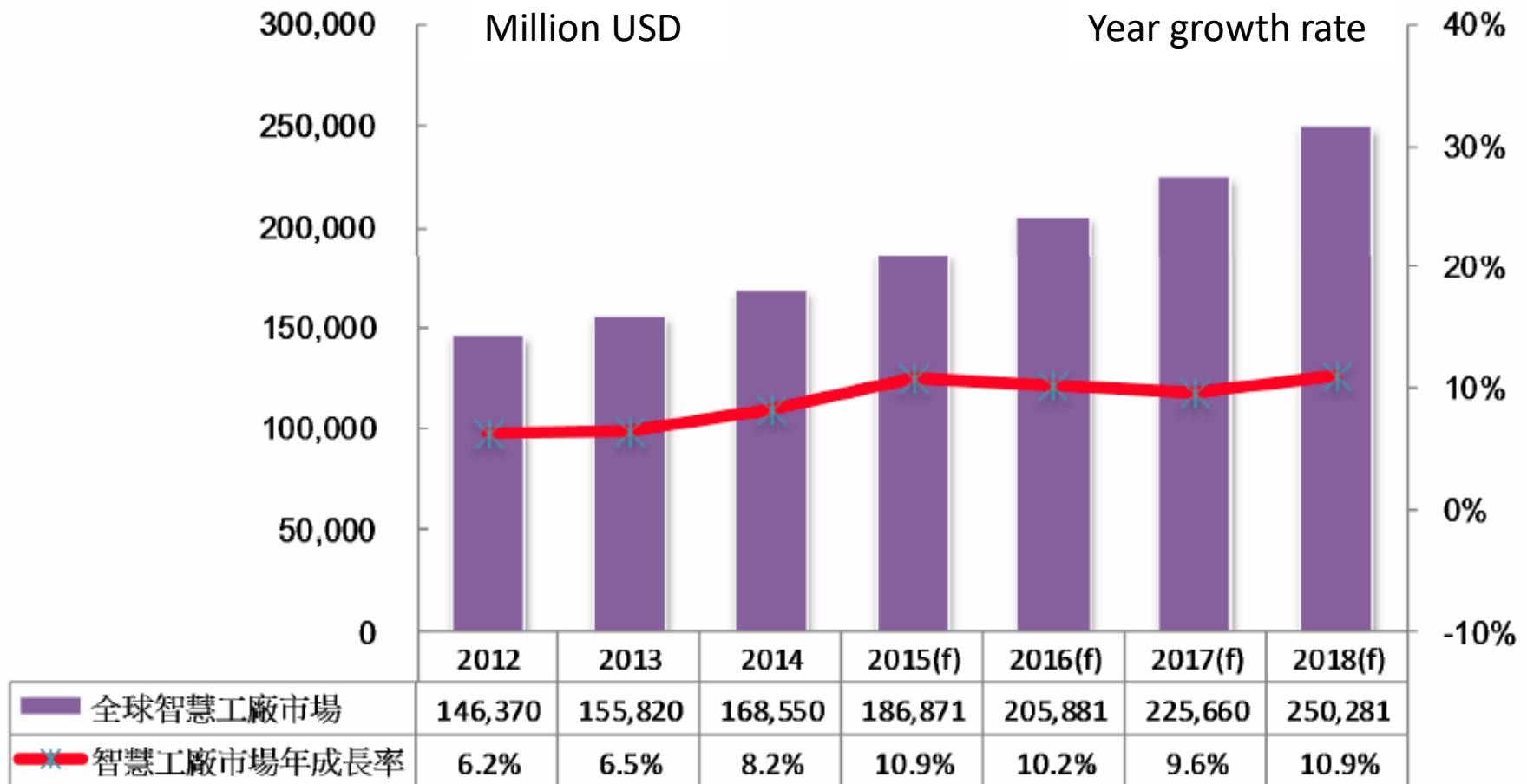


# Background of Industry 4.0



# Capacity of Smart Manufacturing 2012-2018

2012~2018年 全球智慧工廠市場規模與預估

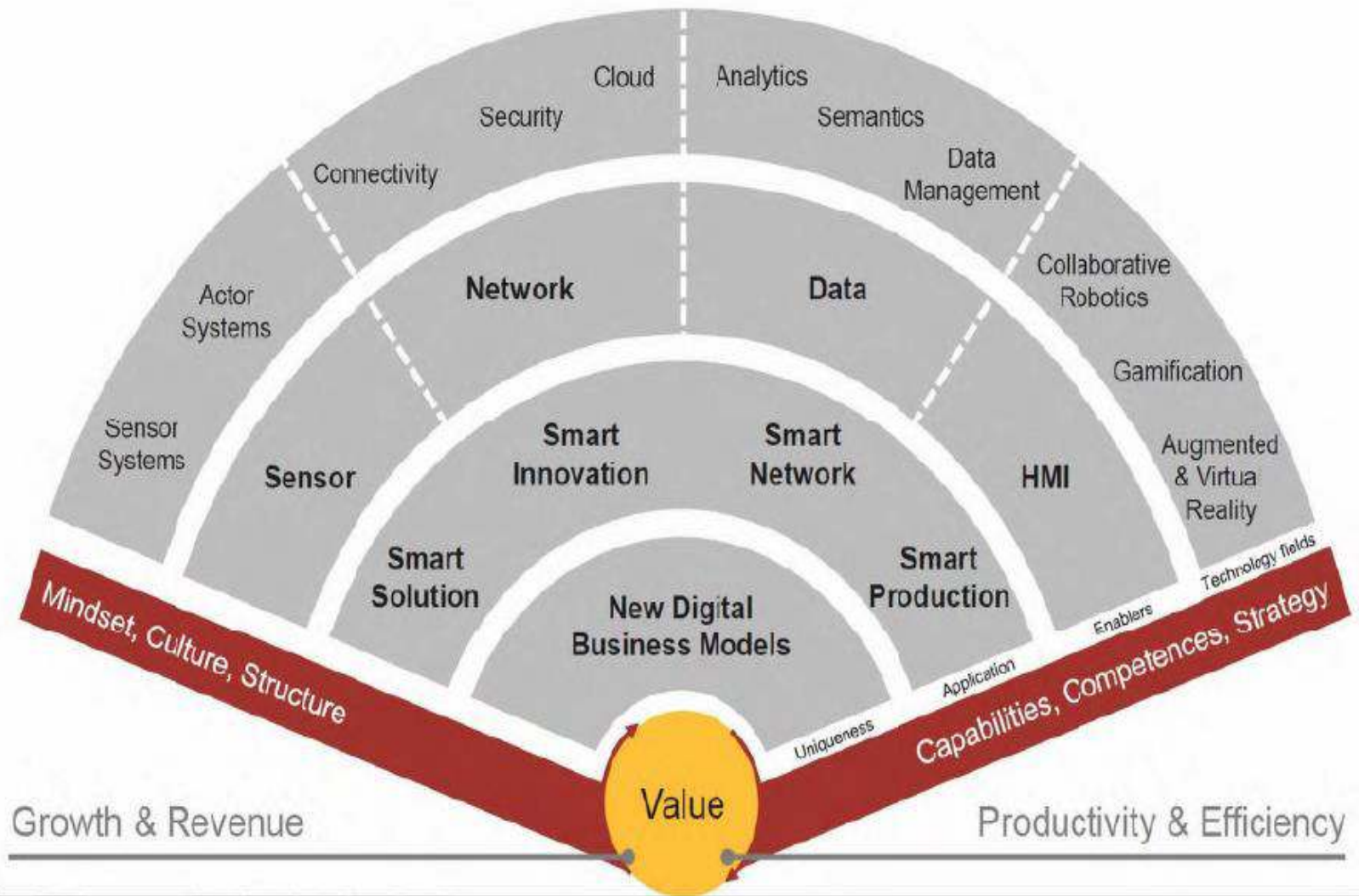


資料來源：MIC整理，2015年4月

Sources: MIC. Taiwan; 2015/04

# Industry 4.0 Technical Perspective

(From the Fraunhofer, Germany)



# 9 key technologies for Industry 4.0

## Key customer requirements (Industrie 4.0)

Reducing the time to market



- Shorter innovation cycles
- More complex products

Enhancing flexibility



- Individualized mass production
- Volatile markets

Increasing efficiency



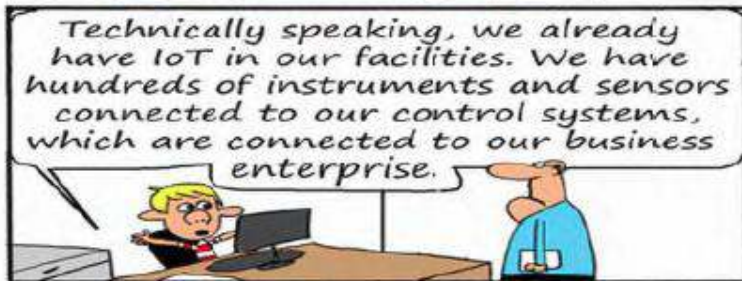
- Energy and resource efficiency as key competitive factors





# IoT Technology and Industry 4.0

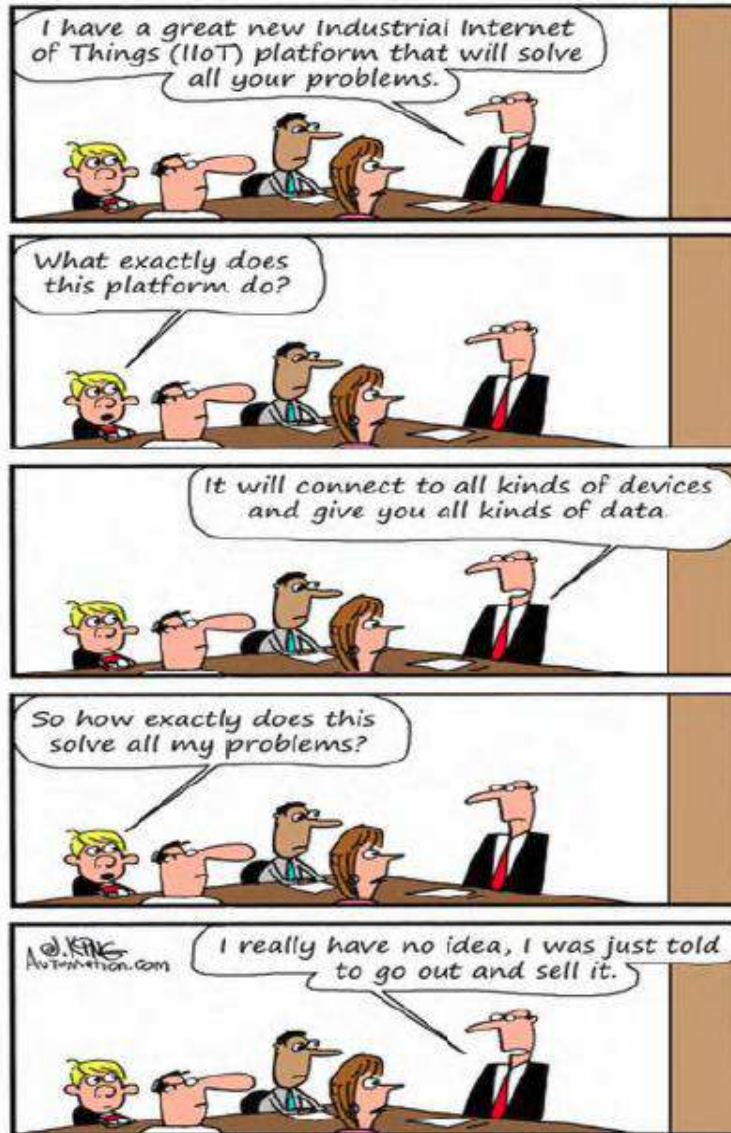
([www.automation.com](http://www.automation.com))





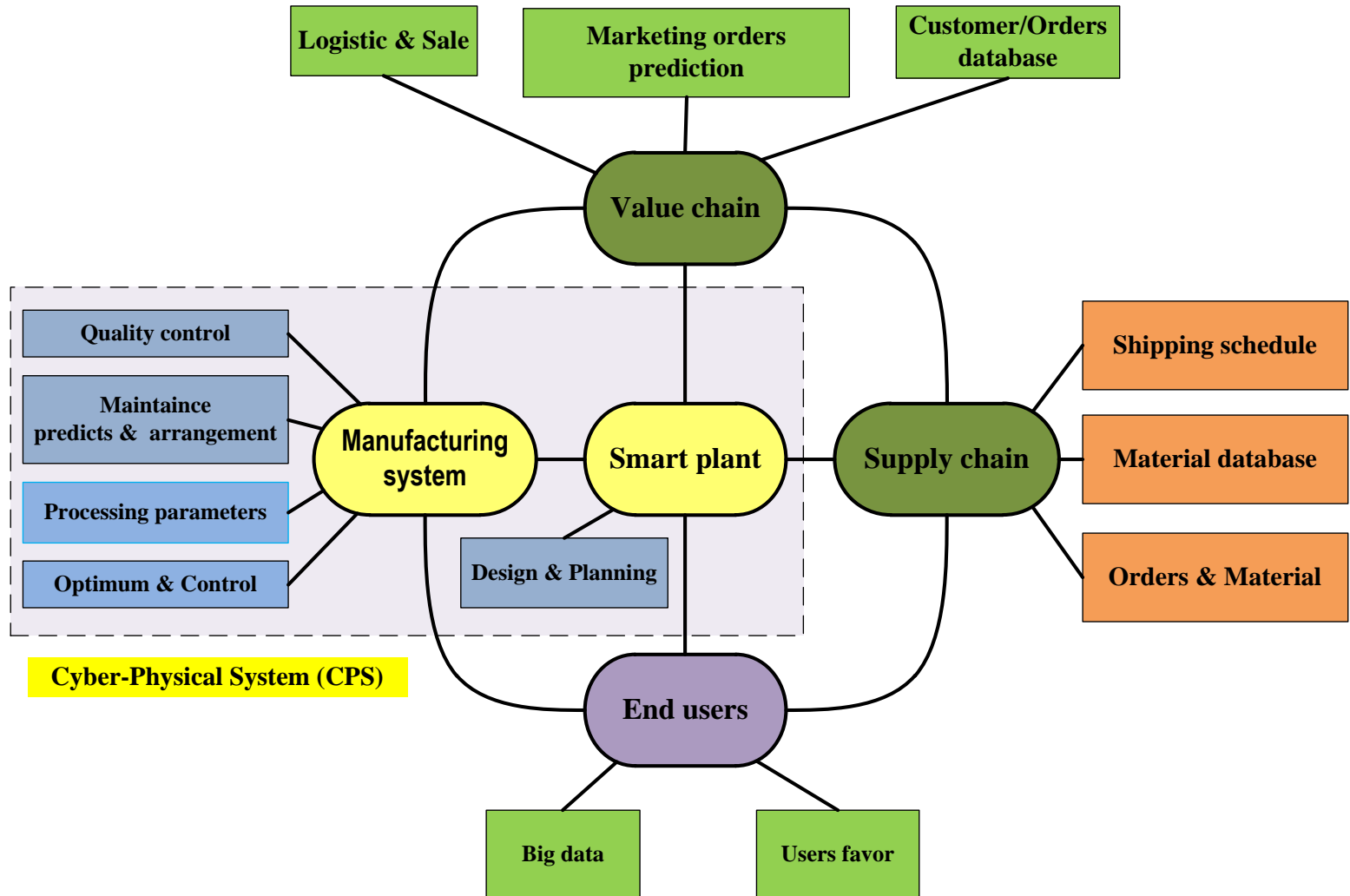
# Why needs Industrial Internet of Things (IIoT)?

(www.automation.com)





# Industry 4.0 Eco-system





# Industry 4.0

## Industry 4.0 That include 6M + 6C:

(China Academician Dr. Wu He-Chuen 中國工程學院鄔賀銓院士)

### 6M:

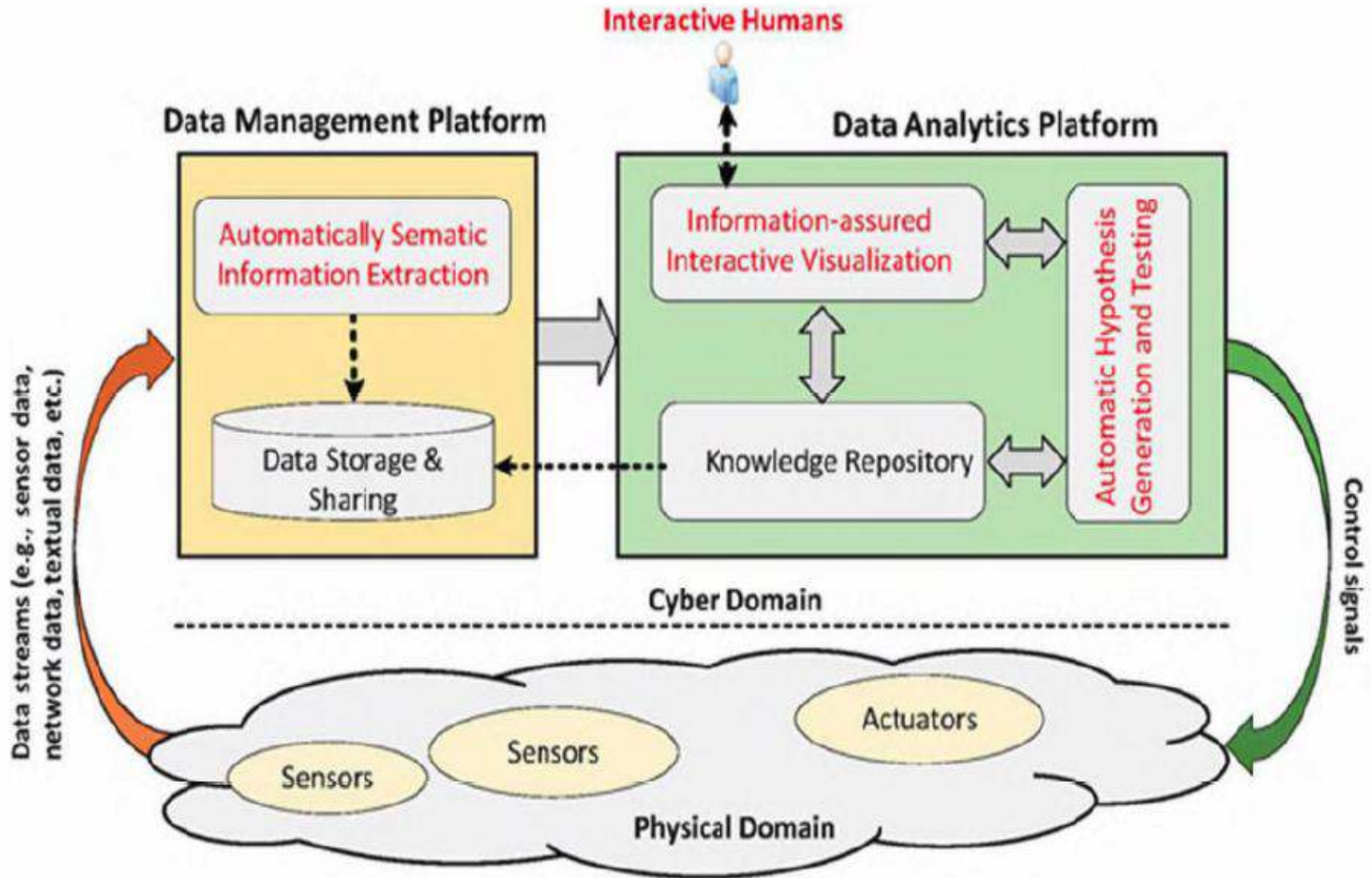
Model, Material, Measurement, Method, Machine, and Maintenance.

### 6C:

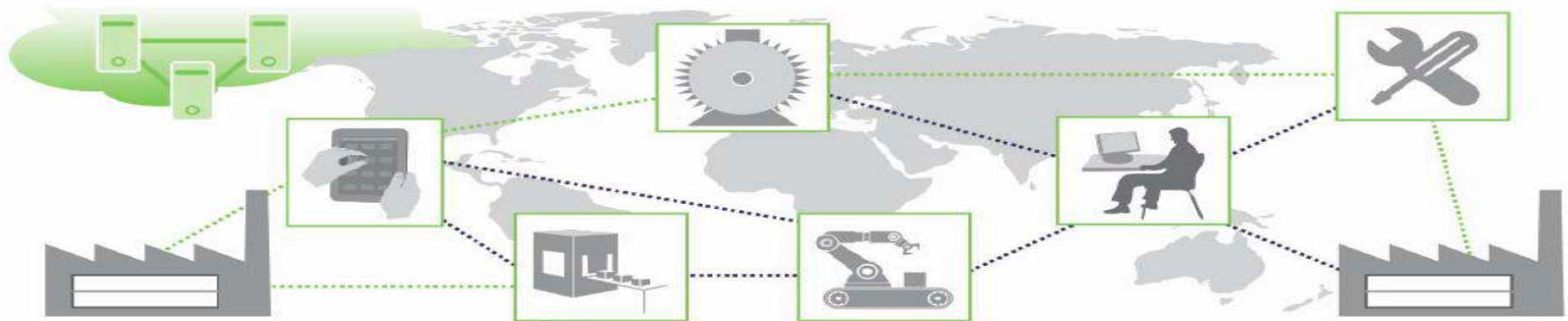
Content, Cyber, Cloud, Connection, Community, and Customization.



# Cyber-Physical System



# Innovative Services Model for Industry 4.0



The Smart Grid

Real time information flows  
Reporting on availability, traceability & movement of products

Optimise resource and energy use vs. production

Customers

Brands /  
Distribution  
Centres

OEM

Other Network Partners

Create agile networks able to respond to  
Rapid demand changes

Material/Parts  
Suppliers

Higher product availability & lower  
inventories

Mass customisation  
Traceable  
Recyclable / remanufactured

Your Smart Factory

Close links into supply  
chain/networks  
Optimise production  
performance

Optimise production and minimise cost

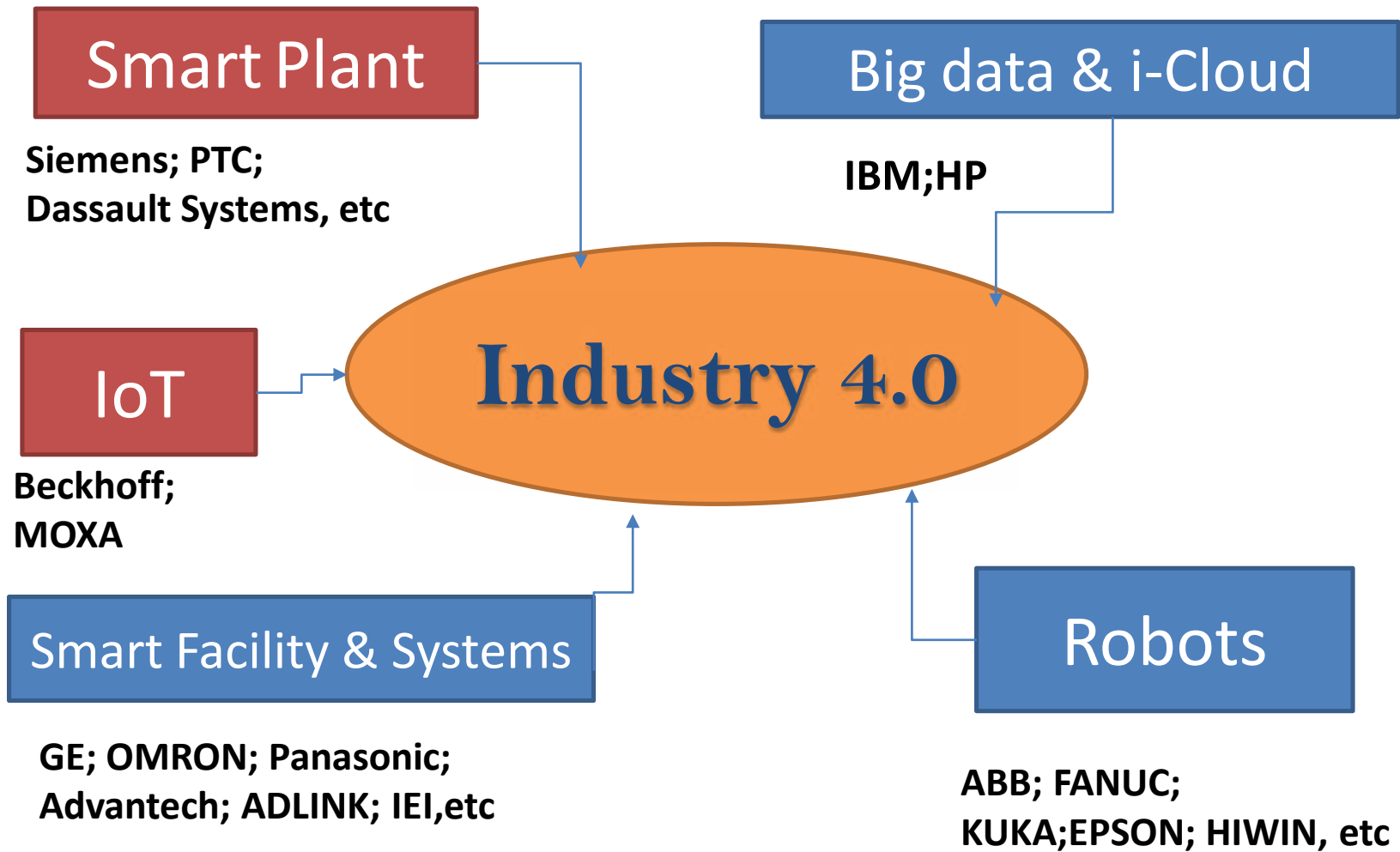
Business Systems

Sources: AP Benson, 2014/08

Demand



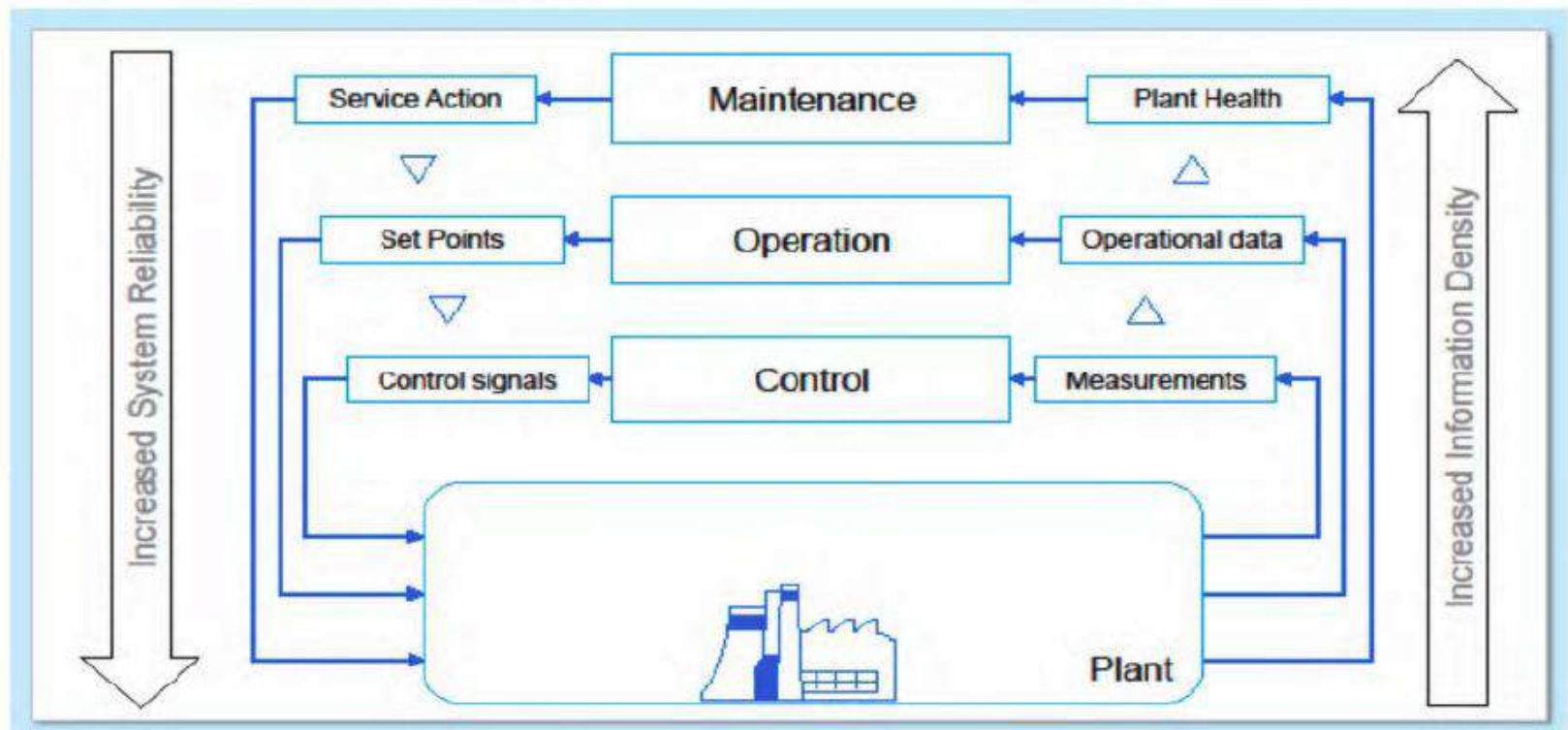
# Big Players at Industry 4.0



# Level for Reliability and Information Density

(Professor Alf J. Isaksson, ABB, Västerås, Sweden)

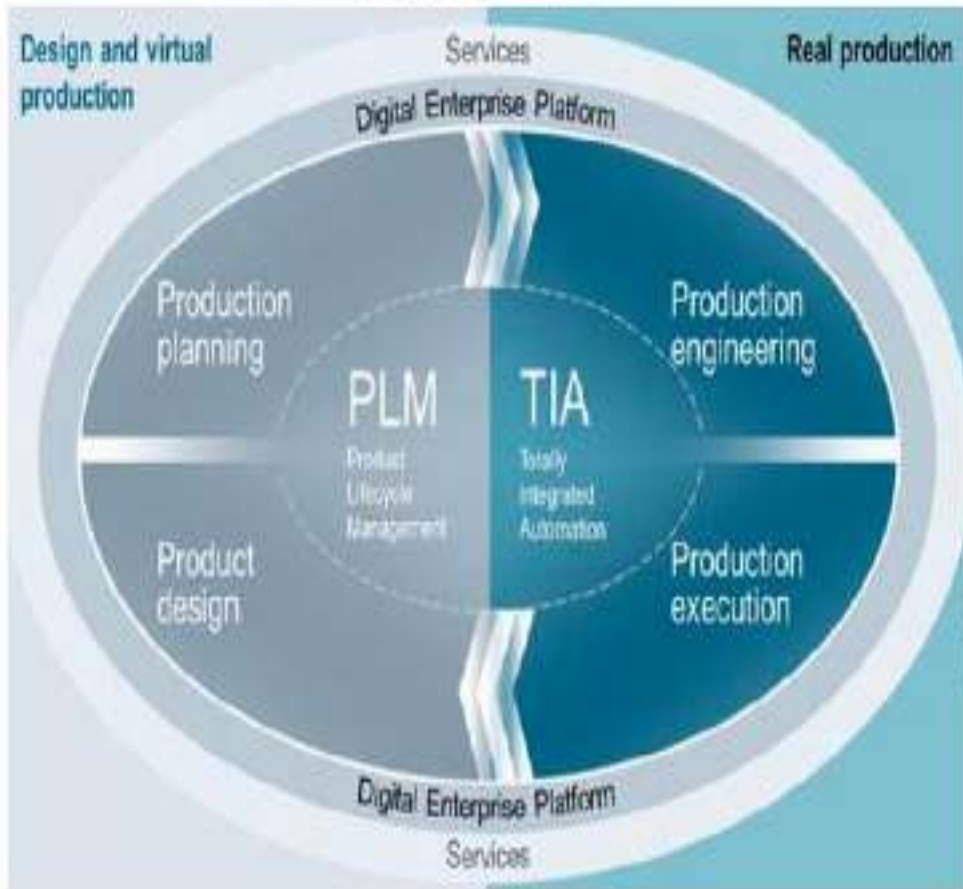
## Information Management Reliability vs. Information Density



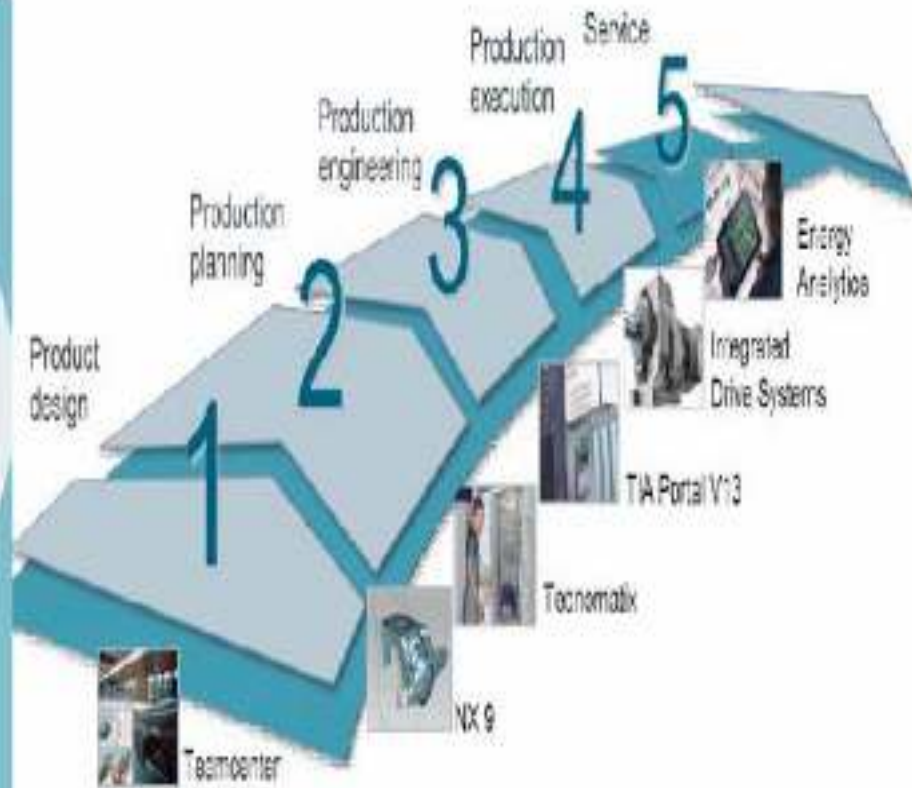


# Siemens Example, Germany

Siemens 虛實整合平台



Siemens 產品開發流程



# Siemens Industry 4.0 example

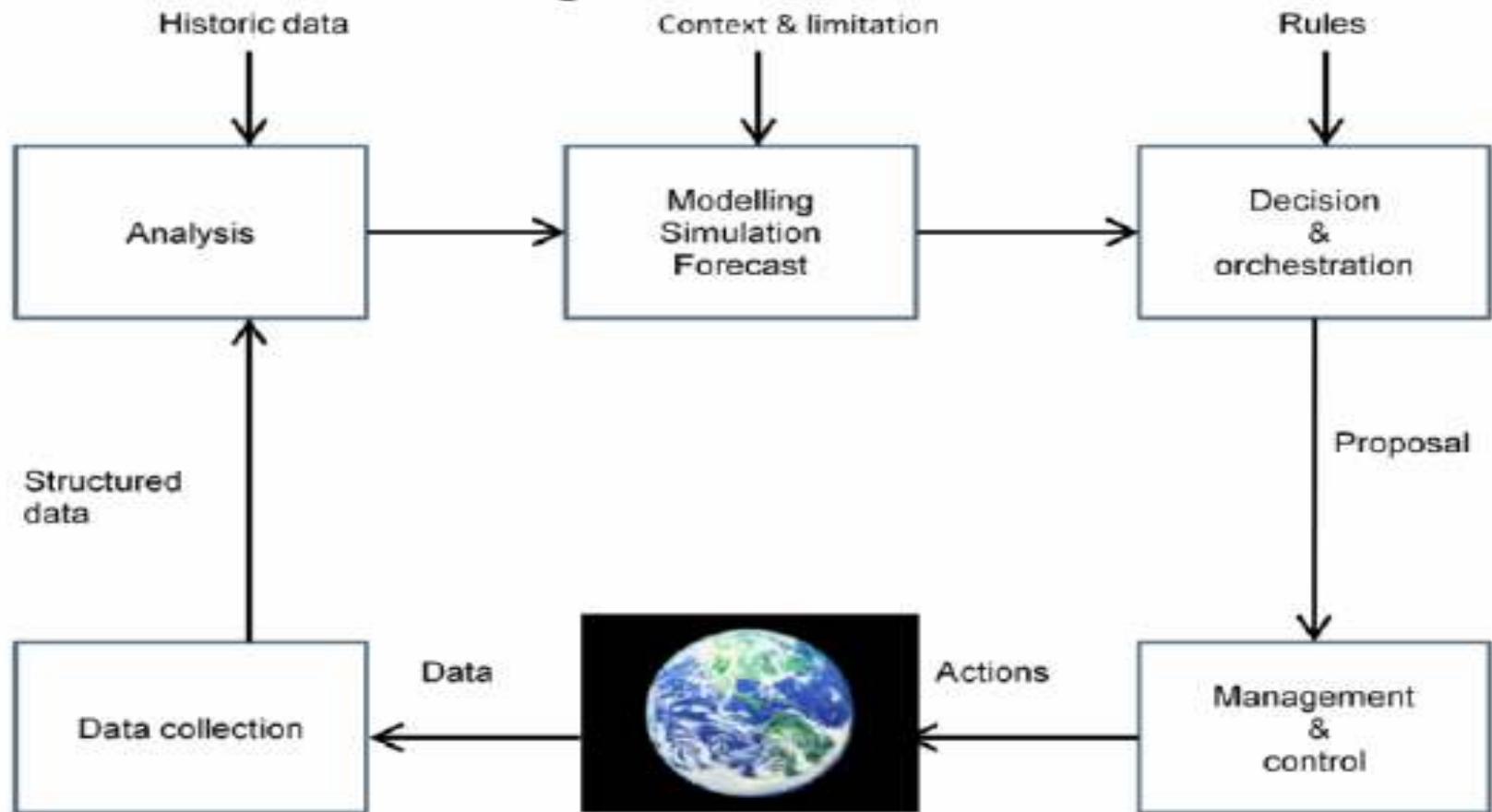




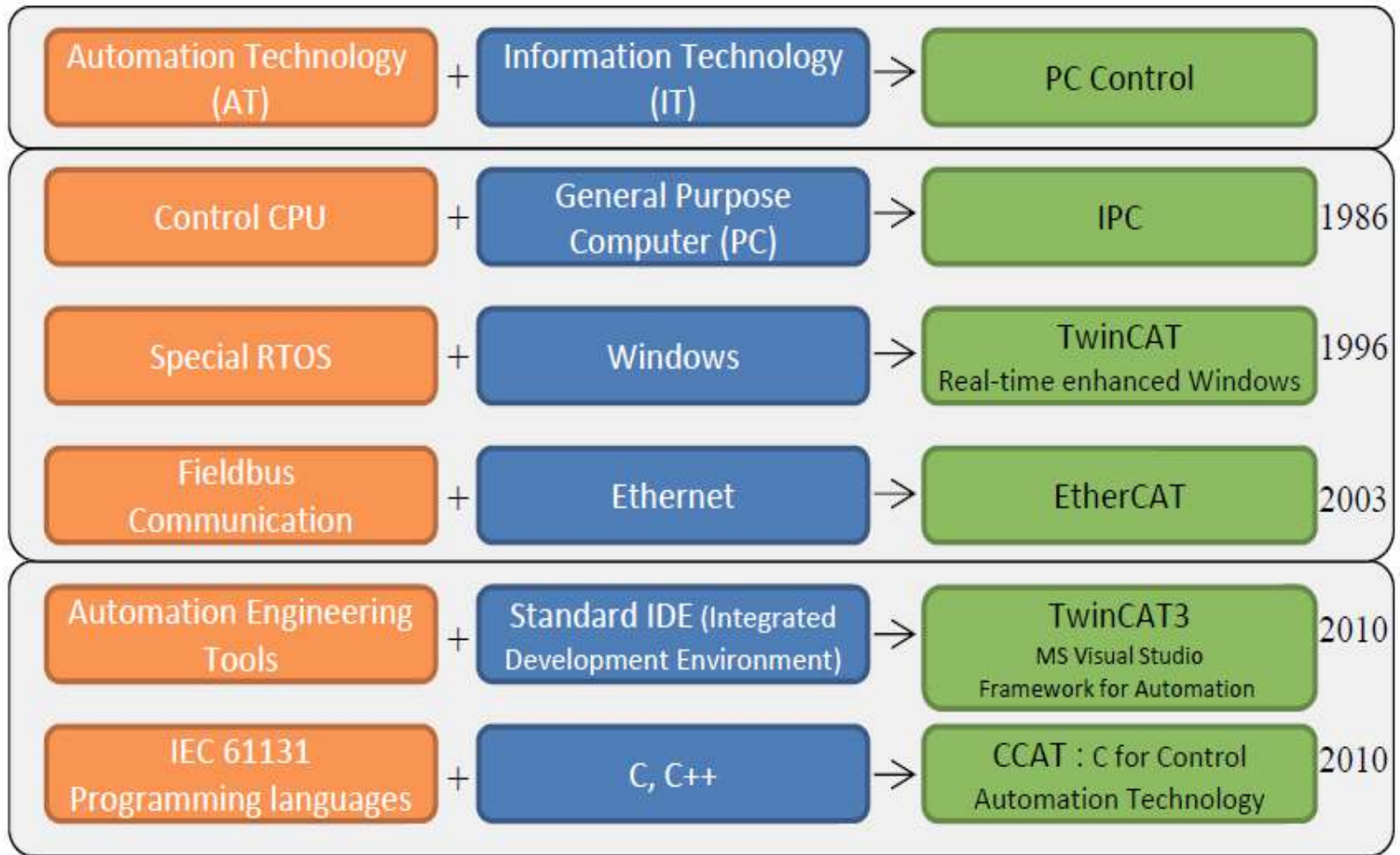


# IBM Strategy

## Big Data Value Chain



# Beckhoff for IoT



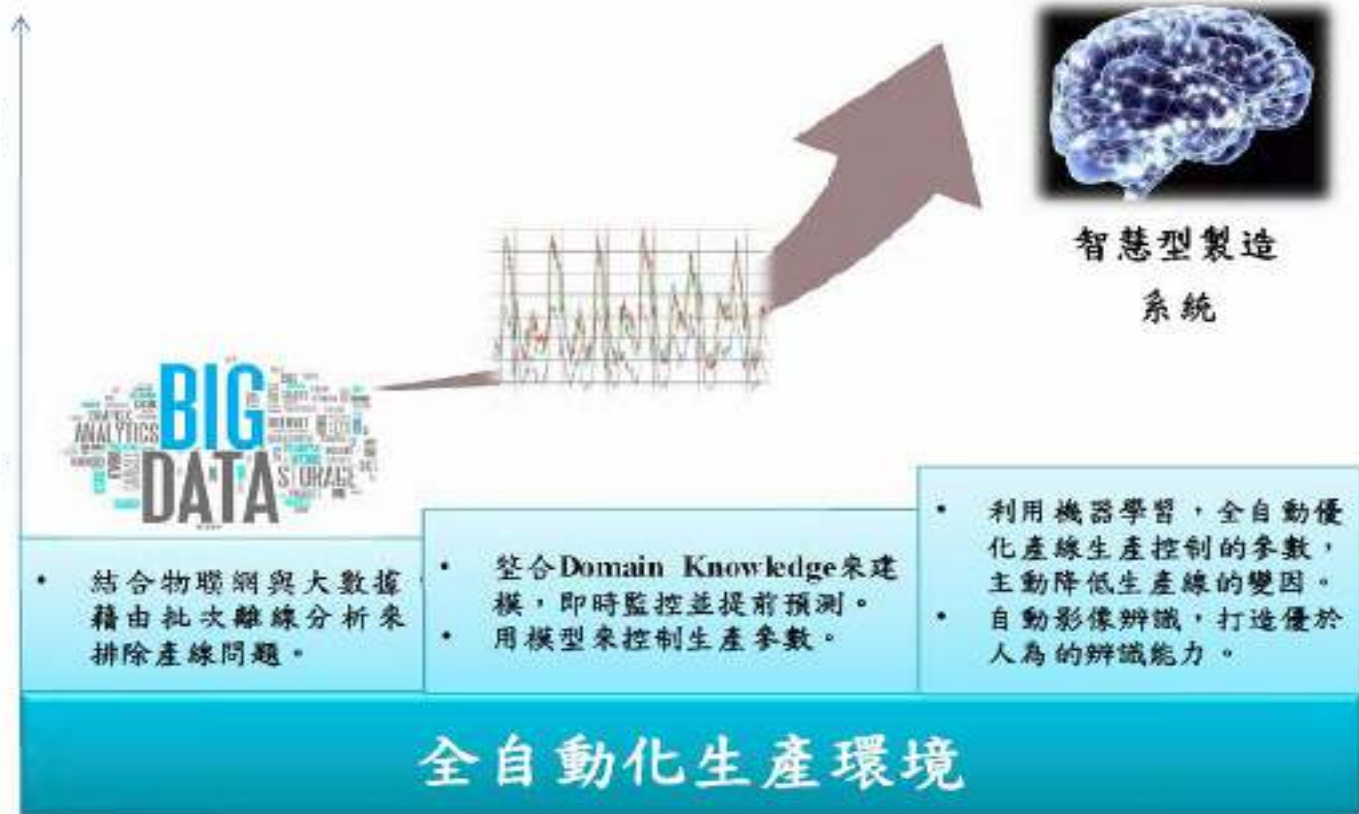
資料來源：Beckhoff，2014年9月

Since 2003 promoted EtherCAT, now the standard and code of IoT are coined by Beckhoff

# From Automation to Smart Manufacturing (TSMC)

## 邁向智慧型的製造系統

(Modified from: Taiwan Semiconductor Manufacturing Company, 2017/2/7)





# iMS, Cincinnati, USA

The general framework of the application of PHM algorithms in detecting invisible issues in industry using Watchdog Agent® tool

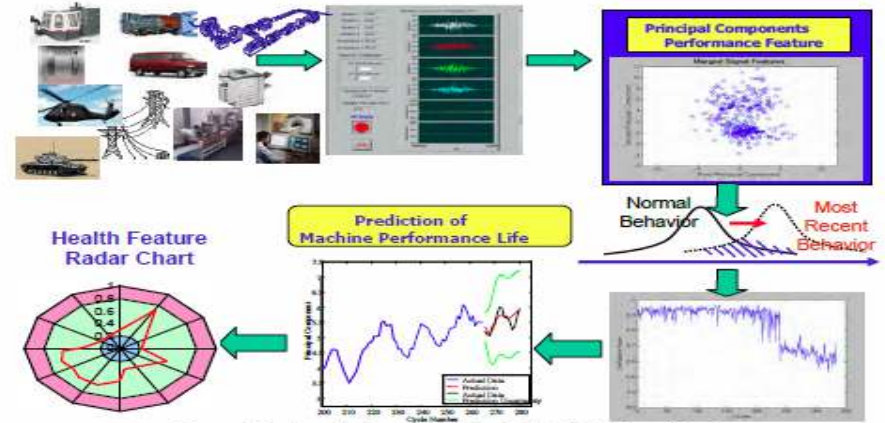


Figure 1. Systematic Approach to Apply Watchdog Agent® Tools

## Applications

The Watchdog Agent® Toolbox has been developed and packaged on different hardware and software platforms. The tools are employed and validated using real-world data supplied by different company test-beds from various industries to achieve different diagnostics and prognostics tasks. A portfolio of selected IMS projects is listed in Table 2. The results are delivered in different forms such as technical reports, software & hardware platforms, paper publications or patents.

Table 2. Selected IMS Project Portfolio

COMPANY	PROJECT
General Motors	Prognostics of Vehicle Components
Harley Davidson	Spindle Bearing Monitoring
Toyota	Assembly Robot Monitoring
Caterpillar	Machine Tool Health Monitoring
PMC	Fixed Cycle Feature Test
Proctor and Gamble	Quality-centric Process Health Management
Omron	Precision Energy Management Systems
Semiconductor	Predictive & Preventive Maintenance
Techsolve	Smart Machine Platform Initiative (SMPI)
Siemens	Reconfigurable Plug-n-Prognose Watchdog Agent®

# China Industry 4.0

中國大陸國務院總理李克強3月5日政府工作報告，談及經濟結構轉型優化時強調，要實施「**中國製造2025**」，堅持**創新驅動、智能轉型、強化基礎、綠色發展**，加快從製造大國轉向**製造強國**

## 發展狀態

2015年3月

工信部等相關部門正在制定《中國製造2025》規劃，即將上報國務院

2014年1月

中國工程院啟動並開展《製造強國戰略研究》諮詢專案，專案明確提出中國大陸成為製造強國的階段性目標和各項指標

## 重要意涵

- **兩個百年目標**。到2020年，中國大陸要基本實現工業化，這是第一個百年目標，到2050年實現第二個百年目標，邁入世界工業強國
- **製造業強國進程三階段**。2025年大陸製造業邁進製造強國；2035年成為名副其實的製造強國；2045年成為具有全球影響力的製造強國
- 工業是服務業的重要基礎，**製造業服務化是工業化的戰略取向**。製造業服務化是工業化的戰略取向，要重視發展實體經濟，防止工業空心化和邊緣化
- 促進工業**向優質、綠色、低碳轉型**，解決的關鍵在於**創新驅動**